## Lesson 18: Expressions with Rational Numbers

Let’s develop our signed number sense.

### 18.1: True or False: Rational Numbers

Decide if each statement is true or false. Be prepared to explain your reasoning.

1. $\left(-38.76\right)\left(-15.6\right)$ is negative
2. $10,000−99,999<0$
3. $\left(\frac{3}{4}\right)\left(-\frac{4}{3}\right)=0$
4. $\left(30\right)\left(-80\right)−50=50−\left(30\right)\left(-80\right)$

### 18.2: Card Sort: The Same But Different

Your teacher will give you a set of cards. Group them into pairs of expressions that have the same value.

### 18.3: Near and Far From Zero

| $a$ | $b$ |     $-a$     |     $-4b$     |   $-a+b$   |   $a÷-b$   |     $a^{2}$     |     $b^{3}$     |
| --- | --- | --- | --- | --- | --- | --- | --- |
| $-\frac{1}{2}$ | 6 |  |  |  |  |  |  |
| $\frac{1}{2}$ | -6 |  |  |  |  |  |  |
| -6 | $-\frac{1}{2}$ |  |  |  |  |  |  |

1. For each set of values for $a$ and $b$, evaluate the given expressions and record your answers in the table.
2. When $a=-\frac{1}{2}$ and $b=6$, which expression:
* has the largest value?
* has the smallest value?
* is the closest to zero?
1. When $a=\frac{1}{2}$ and $b=-6$, which expression:
* has the largest value?
* has the smallest value?
* is the closest to zero?
1. When $a=-6$ and $b=-\frac{1}{2}$, which expression:
* has the largest value?
* has the smallest value?
* is the closest to zero?

#### Are you ready for more?

Are there any values could you use for $a$ and $b$ that would make all of these expressions have the same value? Explain your reasoning.

### 18.4: Seagulls and Sharks Again



A seagull has a vertical position $a$, and a shark has a vertical position $b$. Draw and label a point on the vertical axis to show the vertical position of each new animal.

1. A dragonfly at $d$, where $d=-b$
2. A jellyfish at $j$, where $j=2b$
3. An eagle at $e$, where $e=\frac{1}{4}a$.
4. A clownfish at $c$, where $c=\frac{-a}{2}$
5. A vulture at $v$, where $v=a+b$
6. A goose at $g$, where $g=a−b$

### Lesson 18 Summary

We can represent sums, differences, products, and quotients of **rational numbers**, and combinations of these, with numerical and algebraic expressions.

Sums:

$\frac{1}{2}+-9$

$-8.5+x$

Differences:

$\frac{1}{2}−-9$

$-8.5−x$

Products:

$\left(\frac{1}{2}\right)\left(-9\right)$

$-8.5x$

Quotients:

$\frac{1}{2}÷-9$

$\frac{-8.5}{x}$

We can write the product of two numbers in different ways.

* By putting a little dot between the factors, like this: $-8.5⋅x$.
* By putting the factors next to each other without any symbol between them at all, like this: $-8.5x$.

We can write the quotient of two numbers in different ways as well.

* By writing the division symbol between the numbers, like this: $-8.5÷x$.
* By writing a fraction bar between the numbers like this: $\frac{-8.5}{x}$.

When we have an algebraic expression like $\frac{-8.5}{x}$ and are given a value for the variable, we can find the value of the expression. For example, if $x$ is 2, then the value of the expression is -4.25, because $-8.5÷2=-4.25$.



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